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Jørgensen, Kirsten; Duijm, Nijs Jan; Troen, Hanne

Published in:
International Journal of Workplace Health Management

Link to article, DOI:
[10.1108/17538351111143330](https://doi.org/10.1108/17538351111143330)

Publication date:
2011

[Link back to DTU Orbit](#)

Citation (APA):
Jørgensen, K., Duijm, N. J., & Troen, H. (2011). Demonstration of Risk Profiling for promoting safety in SME's. *International Journal of Workplace Health Management*, 4(2), 179-193.
<https://doi.org/10.1108/17538351111143330>

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Demonstration of risk profiling for promoting safety in SME's

Kirsten Jørgensen,¹ Nijs Jan Duijm,² Hanne Troen³

Abstract

The questions to be answered in this research are how to identify and assess the risks for accidents including risks that do not normally result in accidents but are still highly represented in the statistics, how to help SME's become aware of the risks that are most important to prevent and how to make risk assessment easy to implement for the employer and the employee in their day-to-day work.

The article considers the dilemma that although accident frequency is higher in SME's, most small companies experience no serious accidents; thus, they are not challenged to focus on safety, neither being aware of the risk of accidents nor being able to identify risk before the accident happens with the purpose of acting and taking action to prevent accidents.

A Dutch project called WORM has developed knowledge and calculation methods for the risk of accidents in general, but at the moment it is mainly an instrument for use by larger enterprises.

This knowledge could also be of significant value to SME's if the assessment was simpler.

The methods for the research were partly to work with the Dutch results with the purpose of developing simple access to this enormous data and calculation system and partly to investigate the usefulness of the developed tools in real life, while at same time collecting data on both the risks in SME's for two occupations as well as observation of the conditions for these tools to be applied in the SME's

The result is a simple way to go through all types of risks for accidents, a tool for risk observations for external safety experts but useful in SME's and secondly some experiences about the needs and difficulties in arising risk awareness in the small enterprises.

Key words: Accidents, SME's, Risk Assessment, Risk Observation, Carpenters, Caretakers

Problem statement

Approximately 178,000 enterprises with employees are registered in Denmark, as well as 121,000 one-man enterprises. Amongst those enterprises with employees, 85% have less than 20 employees, 10% have between 20 and 50 employees, 3% have between 50 and 100 employees,

¹ Kirsten Jørgensen, Associate professor, Technical University Denmark DTU, Dept. of Management Engineering, DTU building 424, DK-2800 Kgs Lyngby, Denmark, kirj@man.dtu.dk, +4545255149

² Nijs J. Duijm, Senior researcher, Technical University Denmark DTU, Dept. of Management Engineering, building 426, DK-2800 Kgs Lyngby, Denmark, nidu@man.dtu.dk, +4545254547

³ Hanne Troen, Safety Consultant, Kemirisk, Maglekærvej 50, DK-2680 Solrød Strand, Denmark, ht@kemirisk.dk, +4521201505

and only 2% have more than 100 employees⁴. Thus, efforts to reduce the number of occupational accidents should also be targeted at small enterprises.

The frequency of occupational accidents is higher in small and medium-sized enterprises (SME's) than in large enterprises (European Commission 2004). Nevertheless, an SME with a small number of employees will, as a consequence of statistics, seldom experience an accident. Consequently, SME's have little awareness regarding occupational safety due to their own lack of experience.

In many cases, the owner/manager is both the inventor of the product and the founder of the enterprise; therefore, his conceptions of product quality, precision, tempo, order and norms are the basis of the culture and management of the entire enterprise (Hasle & Limborg, 2004). This also holds true for safety. It is generally recognized that safety management and safety culture starts with the manager and his decision that safety should be an important parameter in the enterprise. This is primarily based on experience from larger enterprises, but nothing indicates that this should differ in the small enterprises. However, several studies and legislative interventions have also shown that external supervision or participation with safety perspectives has a positive effect on safety in small enterprises (Frick and Walters 1998, Walters 2004)

Safety initiatives in small enterprises that are based on external participation have been successful in Sweden and several Asian countries, which on the face of it seem to be of a general nature (Kogi, 2006; Frick and Walters, 1998). Other initiatives that support this are, for example, the German "Employer Model" (Eichendorf, 2001) and the Danish project "Control of Order and Safety" (Hasle & Limborg, 2004), where either the insurance system imposes safety requirements on the employers or a research team involves small enterprises with initiatives and knowledge about safety.

The main problem in motivating smaller employers about prioritizing safety is that they do not observe accidents in their own enterprise. They lack a heuristic reference and their own experience is that accidents do not occur and that all is well (Walters, 2001). If a manager decides that safety should be a priority, he needs access to readily available information on the risks he should focus on and how he should act (Kogi, 2006; Hasle et al., 2009). Generally, he has no motivation, knowledge or basis of experience to seek knowledge, and he has no resources or people to help him manage a safety function within the framework of the enterprise. At the same time, he needs his employees to be able function independently, which means that they should have gained insight into how to work safely and plan their work during their basic training (Vickers et al., 2003; Eakin et al., 1998). Surveys show that in this context many smaller employers find it difficult to convince their employees that safety is crucial and that they must be aware of risks and act reasonably in relation to safety (Vickers et al., 2003). They consider it too difficult to supervise, because they cannot be where their employees work all the time. This is especially true in trades such as construction and contracting, transportation and agriculture, where tasks are carried out off site, out of supervisory reach of the owner/manager

⁴ Danmarks Statistikbank, "Erhvervsstatistikken for 2007"

Our problem can thus be stated as follows:

- How can we make the owner/manager of a small enterprise aware of the risks in his enterprise by tapping into the vast experience of similar enterprises before the accident happens in his own enterprise?
- How can we help the owner/manager in prioritizing his limited resources to address the hazards that are likely to cause the highest risk for him and his employees in his enterprise?
- Are there any tools to give to the owner/manager and his employees that help them to control these risks both collectively as well as independently?

One step to solving these problems could be a tool for seeing risks and observing safety barriers, with the aim of making both employers and employees aware of necessary precautions and measures. This tool must be readily available, since SME's have few resources for considering anything but the task at hand. The goal should be to furnish employees with skills that make the way he/she considers how a task should be done is fully integrated with doing it safely.

Another step is to show how external partners can help assess the risk in specific branches or occupations that are characteristic for SME's. As shown in the Dutch project, this kind of assessment is extensive and it will never be feasible for it to be performed by each individual SME.

Finally, we need basic knowledge about the most important actions to be performed by both the employer and the employee in their daily jobs. These actions should become the norm in carrying out daily tasks in order to improve the safety level.

This paper addresses safety and prevention of accidents, but the enterprise may also need to consider chemical risk, musculature risk, psychological risk, noise, etc., leading to health problems due to long-term exposure. This has not been the focus of our research.

The methodological framework

Two aspects are important to note when addressing occupational safety in small companies. Firstly, as opposed to large companies, most small companies have never experienced serious occupational accidents and thus the problem is not considered to exist. Secondly, small companies lack the resources to collect knowledge about occupational safety and to develop management strategies for accident prevention. Small enterprises may very well want a high safety level, but in many cases they do not know enough about what it means and what risks are most important to focus on.

Especially for accidents, job analyses will be more time consuming and in many cases insufficient because the accident risk constantly varies for the small enterprise's task.

The method described in this article is based upon the Dutch WORM project, which has developed an electronic risk calculator that makes it possible to be told which risks are most important based upon a description of what one works with and how.

This risk calculator is, however, comprehensive and requires many details, which would not be realistic to expect small businesses to collect, even though they would be the ones who would have the greatest benefit from such knowledge.

This article demonstrates how external players can collect the necessary knowledge among small enterprises within, for example, a certain occupation and create concrete knowledge about this occupation's average risk profile for the small enterprises within the occupation.

Furthermore, it is demonstrated how the collection of knowledge can provide the basis for instruction of simple and clear efforts, which will continue to significantly decrease the risk of accidents in the business.

The Dutch project (WORM) has developed a risk assessment model for occupational accidents, based on an analysis of more than 9,000 serious accidents in the Netherlands, along with a comprehensive assessment of exposures. For the exposure assessment, data was collected on how often and how long workers performed certain actions and the way they did it could be linked to the accident analysis. For the first time ever this makes it possible to determine the real risk of ordinary occupational accidents with respect to fatality, permanent and serious injury. This can be done for any level of industry sector and type of job, as well as for any kind of job or activity.

The WORM project utilised an accident model based on the idea of so-called "bowties" (Hale et al, 2007). Bowties are graphical representations of accident scenarios, where the central accident hazard is positioned in the centre; possible causes are displayed on the left-hand side of the centre, and potential consequences on the right-hand side. This model recognizes that there are several possible cause-event sequences (pathways) to the accident, and that there are one or more "safety barriers" that either prevents the single causes each time from developing into a real accident or that mitigate the consequences of the accident. The safety barrier represents actions or provisions preventing or mitigating the accident. The WORM project also introduced conditions promoting the quality of the safety barrier, i.e. conditions promoting the rate of success to prevent the accident. These conditions are observable, in other words, the WORM project made a link between the presence of a set of observable conditions, prior to the accident, and the likelihood that this accident may occur. This is an important achievement. On one hand, it allows assessment of the occupational risk, i.e. the likelihood of accidents, on the basis of an assessment of these conditions, without the accidents happening. On the other hand, it provides a tangible means of intervention and improving safety by addressing and changing these observable conditions.

The WORM project identified 64 generic hazards based on the analysis of 9,000 accidents with either serious or fatal consequences. These 9,000 accidents were all accidents investigated by the labour inspectorates over a 4-year period. The analysis identified the safety barriers related to all 64 risks as well as the aforementioned observable conditions for all of these safety barriers, and, using the statistical analyses for these 9,000 accidents, the relation between each of these observable conditions and the likelihood of an accident. In combination with the exposure study,

it allows us to generate an objective probability of an accident, given an employee is exposed to one or more of these 64 hazards. For this purpose, the “WORM risk calculator” was developed. For further information see Ale B. (2006) and the WORM Metamorphosis Consortium (2008) as well as several articles from the working group.

The WORM project and risk calculator software were primarily targeted toward larger enterprises where a HSE manager is able to make a description of the exposure of the employees to the different hazards, and the status of the safety-promoting conditions in that enterprise.

Managers of SME’s do not have the resources available to generate the data that would enable them to apply the results of WORM directly to their own enterprises (Jørgensen et al, 2010 a).

In order to make the WORM data available for SME’s the following approach was devised:

- Instead of the defining exposure directly to 64 abstract hazards or hazardous activities, we use a limited number (typically 6 to 8) of “tasks” that are specific to a certain occupation, and that are easily comprehended by employers/employees within that occupation: definition of these tasks should be done in dialog with representatives of the occupation, see Table 2 for examples of these tasks.
- For each of those tasks, a standard exposure to the WORM set of hazards needs to be produced. We explored observations of a representative sample of workers performing these tasks, and recording exposure to the WORM hazards, in order to describe this standard exposure.
- Simultaneously with recording exposure to hazards, the state of the safety-promoting conditions can be observed, in order to obtain an impression of the general state of safety within the occupation, and to provide general guidelines for improving safety within the occupation.

These activities need to be repeated for each single occupation, and would be a typical joint responsibility of business associations and trade unions. Once the standard exposures are available, a single small enterprise can easily obtain an impression about what are the most hazardous (i.e. highest risk) situations and what are the most important initiatives to be taken, using a drastically simplified version of the “risk calculator”. The basis for that would be how much time is spent on the different tasks within a specific enterprise, information which is readily available from e.g. planning or budgeting.

The methods and general results from the Danish use and simplification of the Dutch results are presented in (Jørgensen et al 2010 b). In this paper we describe a demonstration of this approach for two occupations, carpenters working with construction and repair of small residential buildings, and caretakers responsible for the daily management of apartment blocks. The study was limited to persons employed exclusively in small enterprises. These two occupations were used as pilot studies to demonstrate how the Dutch study can be used and adapted to meet the needs of small companies.

The idea behind this was that small enterprises would never be able to collect this kind of data or use the risk calculator. But if an external organization could do it and provide the SME’s with

knowledge about their primary risks, it might increase risk awareness and acceptance of safety initiatives.

Observation tools

A tool for data recording was developed to collect exposure data by following employees in real working conditions. The data collection contained both the hazardous activities as well as the safety barriers in place and their quality. This tool was created as a program to be used on a PDA with a step-by-step procedure to guide the observer through the decisions that must be made (Jørgensen et al., 2010 b).

During the development of this tool, we found it necessary to structure the 64 hazardous activities as suggested by the WORM project. Direct selection of one out of 64 hazards would be impractical. We discovered that it is possible to classify these 64 hazardous activities into three levels with 4, 17, and 64 hazards, respectively.

The “zero” level consists of 4 groups as the main gateway to all kinds of hazardous activity.

Table 1 shows this essential gateway to hazardous activities (Jørgensen et al. 2010 a, b).

Each of these main classifications have 2 to 5 subgroups, which then again have 2 to 8 specific “hazardous activities” that are closely related to the specific 64 bowties in the WORM system in a 4-17-64 division (WORM Metamorphosis Consortium 2008; Jørgensen et al., 2010 a, b).

The advantage for this grouping is:

1. That it is much more acceptable to look at the hazards in this stepwise way that makes it easier to see what is in focus at the moment.
2. That it forces the risk assessor to consider all four hazardous activities at level zero that may be present simultaneously.

The method of registration for the occupations consisted of 1) registration of each profession’s specific tasks; 2) activities and hazards for each task; and 3) the quality of the safety barriers.

The data model is shown in figure 1.

Application to two occupations in small enterprises

The method described was applied to two occupations, carpenters working with construction and repair of small residential buildings, and caretakers responsible for the daily management of apartment blocks.

The list of the tasks of carpenters and caretakers was established after consultation with representatives from the two occupations and is shown in Table 2.

The information for each of the two occupations was collected through observation of a total of 20 employees, each of them being observed during three full days. All activities, sources of risk, safety barriers and safety promoting conditions were registered electronically using the PDA program developed for this purpose (Jørgensen et al., 2010 a,b). It was thus made certain that these observations covered various types of tasks within the two occupations’ small enterprises. There was reasonably good correlation between the observed time spent on tasks and the subject’s own perception of how much time they expected to spend on tasks over a year (although the subjects consistently underestimated time spent for breaks, especially the

caretakers). The electronic registration of the 60 observation days for each profession was then transferred electronically to the WORM risk calculation program. Then, an average exposure evaluation was calculated for each profession and a risk profile was made.

Information about the spread of each task throughout the year, together with some management factors, was gathered through interviews with both the manager and the employees in the firm. In these interviews, questions were asked regarding:

- The practical and safety conditions in relation to each task
- How often each task was carried out on an annual basis
- To what extent the observed risk activities for each task applied generally on an annual basis
- To what extent the observed safety barriers, their quality and presence, applied generally on an annual basis

The enterprises were found through contact with the respective branch safety councils, together with information from phonebooks and our own contacts. It can be discussed how representative the firms are that were involved in the data collection, since there were 5-7 firms per branch that were willing to participate in a project on safety. The data collected may therefore present an exceedingly positive picture of the safety level, but this has not been investigated further.

The following procedure was followed in contacting the enterprises:

- The first meeting with the business consisted of dialogue with the manager and sometimes an employee regarding the aim of the study and what they could expect to gain from it. Agreements were also made about the employees to be followed and when. At this meeting an attempt was also made to gain an overall picture of typical tasks throughout the year, and when each task was carried out. It is important to follow each person as they carry out the different tasks.
- During the agreed period, the selected persons are followed, and the information is registered electronically.
- After the data collection is completed, the manager and employees are interviewed with regard to management factors, including an evaluation of the frequency of the tasks and the presence and quality of the safety barriers.
- On the basis of the registered data, a brief report is written for the enterprises to use in their safety work.

In addition to collecting the necessary data for the risk calculation program, the observations also provided quite a good picture of how work is carried out in a small enterprise, how work is organized by the employer and to what extent each employee is expected to fulfil his tasks on his own.

Results

The results are described in two parts; first, the results from the test of the developed methods for the two occupations including the risk profiles for the two occupations; and second, the general observation and recommendations by means of feedback to the participating SME's.

A general result of the study is that the data structure, both the 4-17-64 classification of hazardous activities as well as the use of occupation-specific tasks that can include a set of hazardous activities turned out to be practicable, as well as the use of a PDA tools for the real-time recording of the observations. The observers need to have good insight in the application of the 4-17-64 classification and an open eye to the presence of hazards, some of which seem trivial (e.g. “walking” coincides with exposure to the hazard “fall on same height”). We used the tool for obtaining information from several SME’s, but we believe the tool also can be used by an HSE officer performing a study in a single (larger) enterprise.

Risk profiles for two occupations

With the aid of the Dutch risk calculation program, risk profiles were calculated for caretakers and carpenters. The calculations are based on the anticipated average time spent on the specific tasks and the observed exposure to hazards involved in these tasks. Figure 2 and figure 3 show results for carpenters and caretakers, respectively (Jørgensen et al., 2010 a). Risk in these figures is expressed as the risk (probability) of fatality, permanent injury or recoverable injury per year for a single carpenter or caretaker employed in a small workshop.

We may ask how well these results compare to the real risks. As the WORM project is, as far as we know, the first study where information about the exposure is collected and thus the only source of risk, there is no other material that we can use for an absolute validation of risk. The only other data we can use for some kind of validation is information about the relative distribution of accident causes for the occupation. In figure 4, we have compared the data presented in figure 2 with the registrations of accident causes for carpenters in the Danish Accident Registry. Only contributions of more than 1% in either the Registry data or our predictions are included. This comparison shows that we predict more accidents due to falls from roofs and scaffolds, and related to moving vehicles, while especially causes from handheld tools, falling objects and extreme muscular exertion are predicted to be less frequent than the registered accidents. An important part of the explanation is that the registry includes Loss Time Injuries , which do not necessarily involve hospitalization, while the WORM data is based solely on accidents with hospitalization. This will explain a large part of the differences regarding muscular exertion and handheld tools (note that according to figure 2 no fatal accidents are predicted). The issue related to moving vehicles can be that the WORM data only covers traffic in the workplace, while the observations have covered driving on public roads.

Observations and recommendations

It became very clear from the observations in the two occupations that the employees had a high degree of independence with regard to their work, and that at least in these two branches the work was performed off site; therefore, the employers are not able to supervise, instruct or control the work. It also became clear that the tasks are very varied, often from day to day, and had to be carried out under conditions over which neither the employers nor employees had complete influence. These two important conditions for both management and safety are

significant in the recommendations made to the enterprises and the recommendations presented in this report (Jørgensen et al., 2010 a, b).

The recommendations are thus divided into two parts: recommendations to the *employer* regarding what should be ensured during planning of the job, and recommendations to the *employees* regarding what they should be aware of in the concrete situations arising on the job. These recommendations are based on an assessment of the safety-promoting conditions that, according to the average risk profiles for carpenters and caretakers and using the data from WORM, are most relevant for these occupations.

The carpenters

An employer in a small carpentry business will usually want to create good safety conditions for his employees, but he does not have many resources to use to search for knowledge or methods. The employer manages the daily administration and distribution of jobs, appointments with customers, purchasing of materials, etc. Once in a while, he may make compromises with safety regulations, sometimes in order to acquire jobs and sometimes to make the logistics work. The employer primarily meets with his carpenters in the morning, when the day's work is assigned, after which everyone drives to their work places, often in pairs. Methods and materials are used that are the easiest to use, and there is the general understanding that this is what you do when you are professional.

Most carpenters work independently, with responsibility for an apprentice or less experienced carpenter. The carpenter often orders his own materials and has responsibility for keeping his car and tools in working order. In many jobs, the carpenter is the only one who can judge the working conditions and evaluate the potential risks. It is the common conception of what is dangerous that applies, i.e. what the carpenter been taught, what is stated in the regulations or what the trade unions have informed about.

The recommendations for the employer of a small carpentry enterprise contain a proposal for a safety and health action plan and recommends procedures and equipment that he must take care of:

1. *Cleaning tools, machines, vehicles, workplaces*
2. *Hoisting of materials*
3. *Placement of electrical wire*
4. *Placement of handheld tools, when not used, in storage or under transport*
5. *Maintenance of tools and machines*
6. *Safety equipment for limiting exposure to dust*
7. *Safety guards on machines*
8. *Working with windows or glass materials*
9. *The availability of personal safety equipment*
10. *The use of mobile telephones during transport*

The recommendations targeting the employees contain a one-page and 10-point risk-awareness program to be ticked off. This takes just a couple of minutes when the employee starts on a new assignment. The points concern controlling the following:

1. *Safety at scaffoldings*

2. *Safety at ladders.*
3. *Safety when working on a roof or at heights*
4. *Safety at tools and machines*
5. *Personal safety protection*
6. *Safety in manual handling*
7. *Safety wherever you are walking*
8. *Safety in handling waste and waste removal*
9. *Safety in transport both at the site and in traffic*
10. *Be conscious of acute risks in the working situation in general*

The caretakers

Caretakers usually have great influence on organizing their own work, which is often carried out at a distance from the property's office and without the employer's direct control. This means that individuals or groups of caretakers are, to a great extent, responsible for their own and the group's safety. Each employee must therefore be able to judge the risks and need for safety measures for him and the group.

Work as caretaker consists to a great extent of manual tasks carried out outdoors. Although it involves some heavy work and some repetitive tasks, the work does not seem to be very burdensome, perhaps with the exception of moving appliances and heavy trash.

Many caretakers are trained artisans who therefore have a professional background for carrying out repair and maintenance tasks. But since this is not a caretaker's primary function, there is a tendency for equipment and facilities not always to live up to professional standards. This is especially true for workshop facilities.

Work with plumbing and rubbish chutes involves many poor working positions due to the fact that facilities for handling rubbish, kitchens, bathrooms and laundries have not been planned with sufficient consideration for necessary repair and maintenance work.

The recommendations for the employer of a small caretaker enterprise contains a proposal for a safety and health action plan and recommends procedures and equipment that he must take care of:

1. *Education of the employees working with machines to work with ergonomically correct positions, also when handling waste*
2. *Motivation to be fit for the job*
3. *Layout of workshops with procedures regarding tasks etc.*
4. *Planning work places and tasks so that safety is ensured*
5. *Motivate safe working behaviour, cleaning, keeping order in the working space*
6. *Adapt tasks to the employees' competences and abilities*
7. *Give instructions for procedures and rules as well for the expected safety behaviour*

And for the employees, the recommendations concern the following:

1. *Safety at machinery*
2. *Working in correct working positions*
3. *Safety in handling waste*
4. *Be fit for the job*
5. *Safety in using the safety equipment*
6. *Safety in using handheld tools*

7. *Safety in using the right procedures*
8. *Safety in cleaning and maintaining the workspace*

Discussion

Through the Dutch risk calculator and observations in small enterprises within two industries, we have been in a position to create a risk profile for 2 trade groups. One may ask about the representivity of the observations and whether the Dutch data is usable in a Danish context. On the other hand, it is hereby demonstrated how one can obtain concrete knowledge about the risk of accidents and safety barriers, which can be used immediately by both the employer and employee in the small enterprises, where one may very well know that safety is important but not necessarily know what it means.

Another topic that the observations resulted in was the employer's limitations in following the employees and the potential for being able to control the performance of the work. This threw the small enterprise's legal obligations, with respect to taking responsibility for safety, in relief.

Insight into the way small enterprises function and the conditions that they function under have provided a basis for evaluating what can be expected and required of an employer in a small enterprise with regard to safety, and also what should and can be expected of the individual employee in relation to continually being aware of eventual risks.

Such a division of responsibilities and obligations clearly requires that employees are instructed and advised, and that possibilities are created for employees to know how to evaluate risks and that they possess the materials, tools and time to work safely. Finally, it is essential that employers motivate their employees to continually assess the risks connected with their jobs and act safely in relation to them. With the knowledge that the risk profile provides, the employer now has the knowledge about what he shall instruct and motivate his employees to do.

The need for both a health and safety action plan for the enterprise and the employer (as the legislation requires) and a list for the employee's own daily risk appraisal has been very apparent in our observations in the small enterprises. It is necessary to train employees to handle their daily risk situations in a professional manner. This does not mean divesting the employer of responsibility, but rather supporting collaboration between employer and employees as well as qualifying the dialogue about working conditions. It is not possible to eliminate all risks of accidents, but it is possible to learn how to handle risk situations in such a way to prevent risks from leading to accidents.

Conclusions

The study has shown it is possible to obtain a reasonable estimate of occupational risk apportioned to occupation-specific tasks by observing the activities and work processes of 30 randomly selected man-days per occupation. The results seem to be consistent with available information from accident registries.

This allows SME's to identify the most important risks for their employees depending on the tasks performed within that SME. The resulting risk profile will then direct to the safety

promoting conditions that would be important to address in order to reduce the risks most effectively.

At the same time, the demonstration study has provided some general insights. It has been obvious from the observations in the two occupations that it is necessary to separate:

- What the employer should manage;
- What the employee must receive instructions about; and
- What the individual employee himself must take care of in order to achieve a higher level of safety.

This is supported by several other research results indicating that it is not until safety is prioritized and created in cooperation between both employer and employee that a low risk of accidents is continually achieved.

Proactive prevention can then be assisted by using tools such as occupational risk profiles, which can be part of the empirical data that must form the basis of proactive prevention.

Based on this knowledge, we can formulate requirements for:

- 1) What the employer can and should take care of;
- 2) What essential instructions and training the employees should receive; and
- 3) Which specific factors the employee should always consider before starting an assignment.

We must stress that our study has focused on providing information on the actual occupational risk of employees in small enterprises. We attempted to make this information available in different formats (as a simplified electronic Risk Calculator, as risk profile graphs, and as information cards recommending safe working practices for both occupations), but we have not evaluated how this may contribute to increased risk awareness and accident prevention in small enterprises.

We have not yet received feedback from companies using the proposed recommendations, and we are waiting for an opportunity to implement and evaluate the use of these recommendations. Apart from these detailed recommendations, it is important that the institutions that interact with SME's (branch organisations, authorities, unions, the educational system) contribute to raising the safety awareness of both employers and employees in SME's. The important message that should be conveyed is that one does not need to wait for an accident, but one should focus on the tangible factors in the daily work that promote safety.

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Table 1 "Zero" level classification of activities to be recorded

| |
|---|
| A. The surface on which you move/work - concerns the risk of falling |
| B. Conditions at the work place - concerns your surroundings where there is a risk of being hit or hitting something, being hit by collapsing or falling objects, flying objects etc. |
| C. What you are working with – concerns the risk of being cut (sharp edges), jammed, crushed, injured by moving tools or chemicals, etc. |
| D. Special dangers – concerns very specific and infrequent high risks such as fire, explosion, drowning, poisoning etc. |

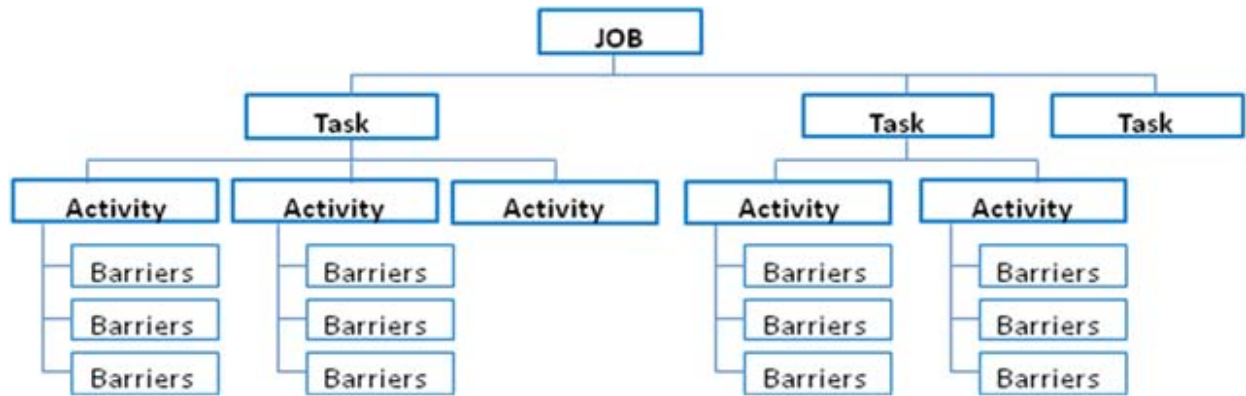


Figure 1, Structure of the data model used for collection of data on exposure in SME's

Table 2, Classification of tasks to be used for data collection for carpenters and caretakers

| Carpenters | Caretakers |
|--|--|
| 1. Construction of new building frame, facades, roofs, windows | 1. Gardening and outdoor area maintenance |
| 2. Indoor construction and fittings | 2. Building maintenance (masonry, carpentry, plumbing, painting, cleaning) |
| 3. Outdoor repair work and renovation | 3. Operation of heating system |
| 4. Indoor repair work, renovation and changes | 4. Ventilation and indoor climate system (technician) |
| 5. Demolition | 5. Waste handling and removal |
| 6. Workshop activities | 6. Administration |
| 7. Transport, driving, goods and waste delivery and collection | 7. General maintenance of technical equipment |
| 8. Administration and customer contacts | 8. Service and support for residents, meetings, and call-up duty |

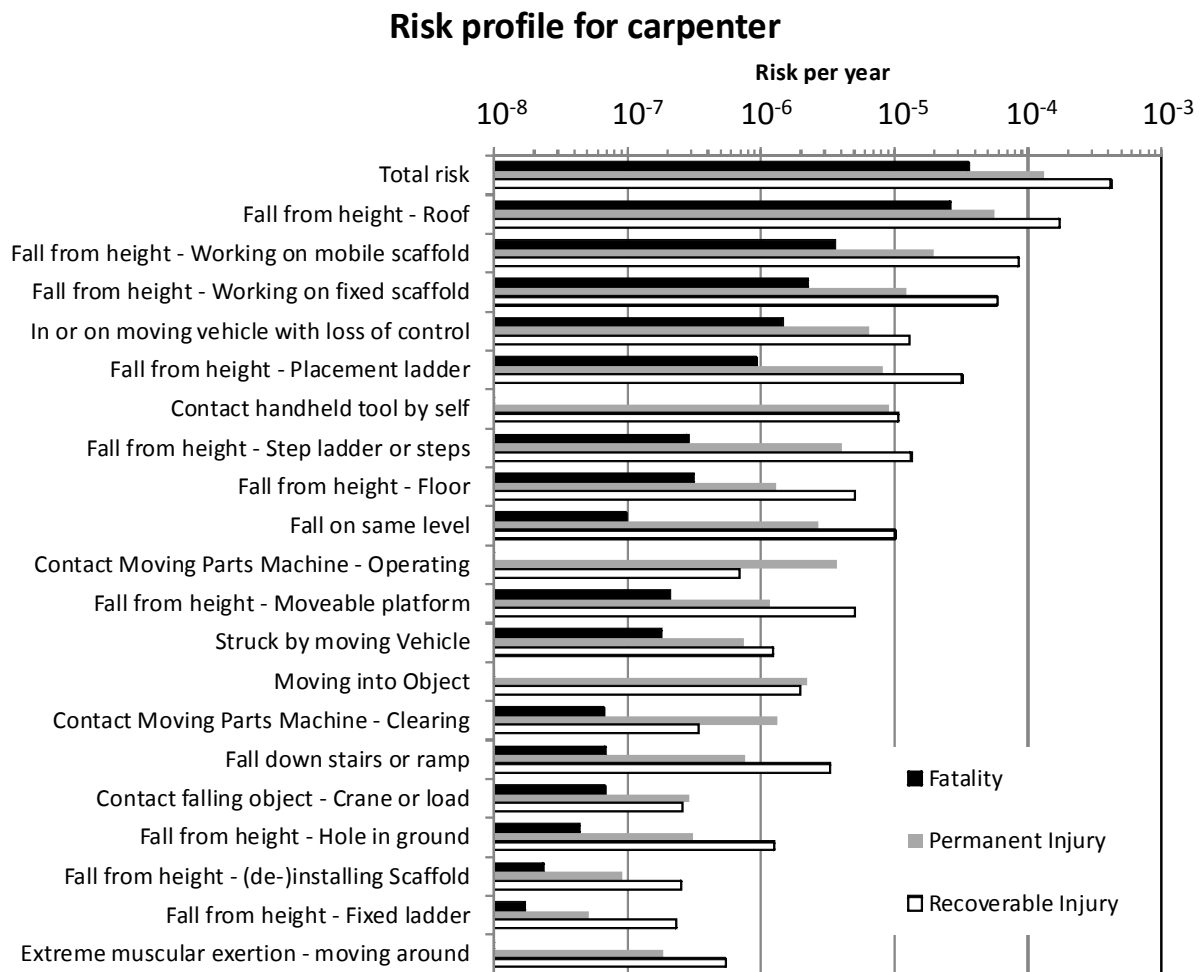


Figure 2, the calculated risk profile for carpenters in small carpentry workshops

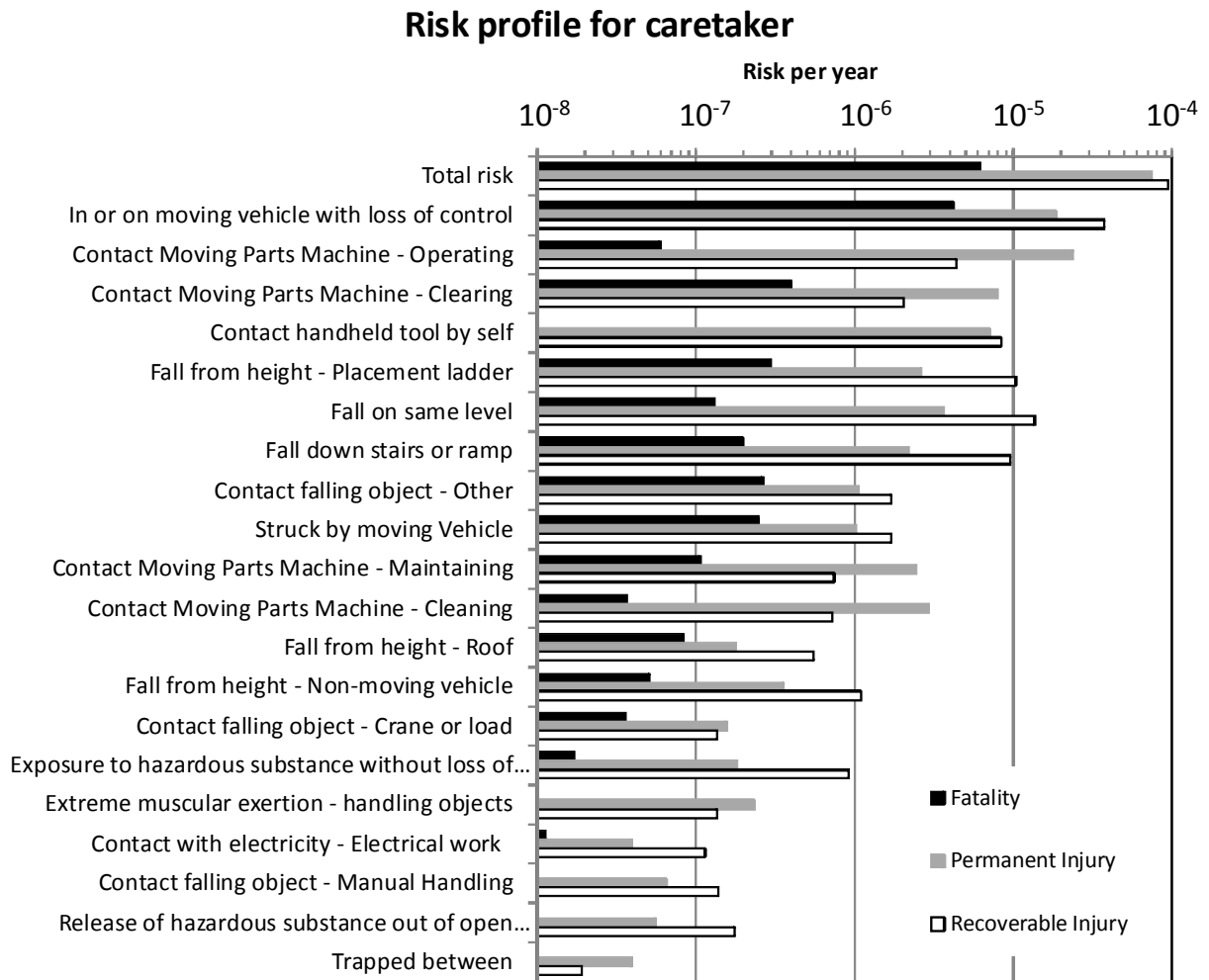


Figure 3, The calculated risk profile for caretakers in small establishments

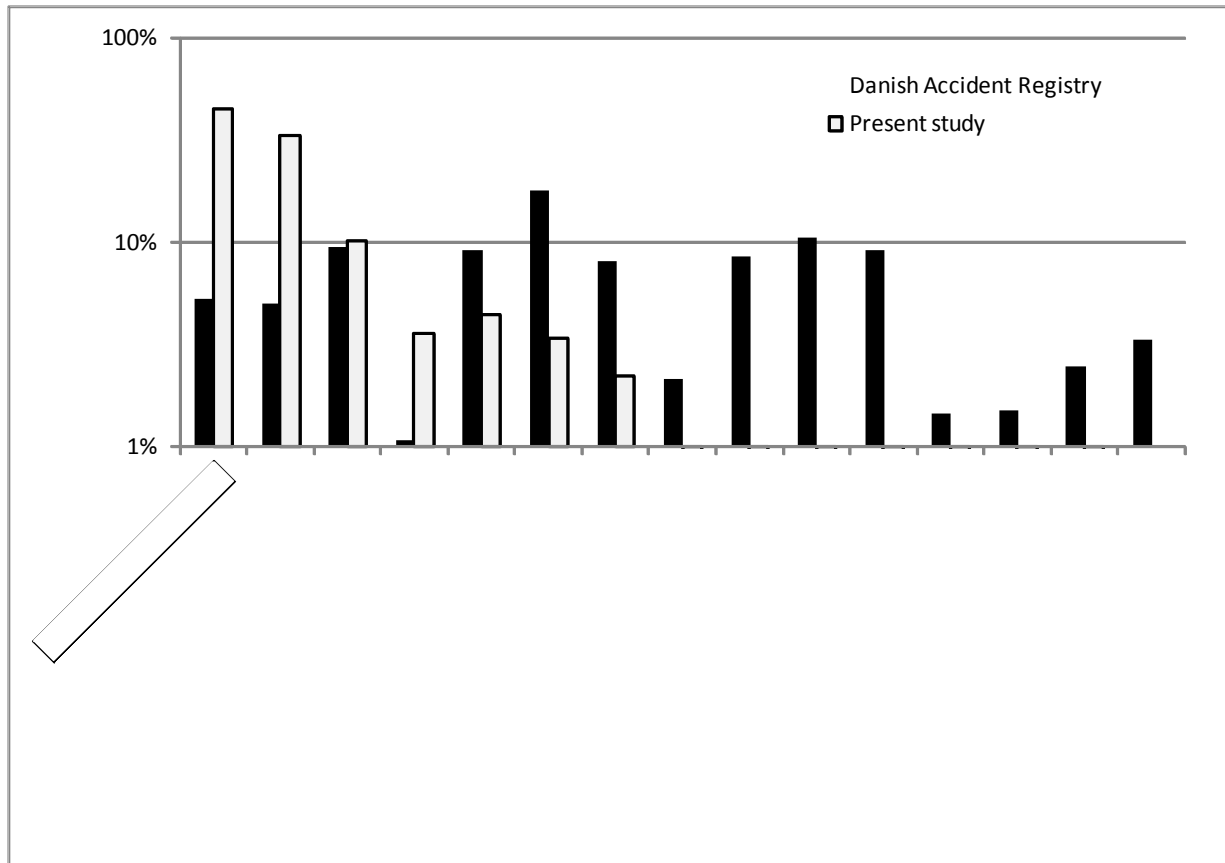


Figure 4, Comparison of the relative frequency of accident causes according to the Danish Accident Registry with the predictions from our study for carpenters